STATUS OF INSECTS

INSECTS AS AGENTS OF DISTURBANCE

Insects are active and significant components of Alaska's ecosystems. Arctic/boreal insects are characterized by having few species and large population numbers. Boreal insects are opportunistic in their behavior. They respond quickly to changes in climate and the availability of food and breeding material. The spruce beetle, for example, responds quickly to large-scale blowdown, fire-scorched trees, and spruce injured by flooding. Large numbers of beetles can be produced in such breeding material, leading to potential outbreaks.

Spruce beetles are one of the most important disturbance agents in mature white spruce stands in south-central and interior Alaska. A variety of changes occur to forest resources when many trees are killed. In the long run these changes are biological or ecological in nature. There are also socio-economic consequences in the short-term that can be viewed as either positive or negative, depending on the forest resource in question. Some of the impacts associated with spruce beetle infestations include, but are not limited to:

1. Loss of merchantable value of killed trees: The value of spruce as saw timber is reduced within three years of attack in south-central Alaska due to weather checking and sap-rots. The value of beetle-killed trees as house logs, chips, or firewood continues for many years if the tree remains standing.

2. Long term stand conversion: The best regeneration of white and Lutz spruce and birch occurs on a seedbed of bare mineral soil with some organic material. Site disturbances such as fire, windthrow, flooding, or ground scarification provide excellent sites for germination and establishment of seedlings if there is an adequate seed source. However, on some sites in south-central Alaska, grass and other competing vegetation quickly invade the sites where spruce beetles have "opened up" the canopy. This delays re-establishment of tree species. Regeneration requirements for Sitka spruce are less exacting; regeneration is thus, less problematic.

3. Impacts to wildlife habitat: Wildlife populations, which depend on live, mature spruce stands for habitat requirements may decline. We expect to see decreases in red squirrels, spruce grouse, Townsend Warblers, and possibly Marbled Murrelet populations. On the other hand, wildlife species (moose, small mammals and their predators, etc.) that benefit from early successional vegetation such as willow and aspen may increase as stand composition changes.

4. Impacts to scenic quality: Scenic beauty is an important forest resource. It has been demonstrated that there is a significant decline in public perception of scenic quality where spruce beetle impacted stands adjoin corridors such as National Scenic Byways. Maintaining or enhancing scenic quality necessitates minimizing impacts from spruce beetle infestations. Surveys have also shown that the public is evenly divided as to whether spruce beetle outbreaks damage scenic quality in backcountry areas.

5. Fire hazard: There is concern that fire hazard in spruce beetle impacted stands will increase over time. After a spruce beetle outbreak, grass or other fine vegetation increases; fire spreads rapidly through these vegetation types. As the dead trees break or blow down (5-10 years after an outbreak), large woody debris begins to accumulate on the forest floor. This material (boles) is the largest component of the fuels complex. Heavy fuels do not readily ignite, but once ignited they burn at higher temperatures for a longer period. The combination of fine, flashy fuels and abundant large woody debris results in a dangerous fire behavior situation. Rate of fire spread may increase as well as burn intensity. Observations from recent fires on the Kenai Peninsula have shown an increase in crown fires. This fire behavior is caused by fire traveling up the dead spruce trees and spotting into the crowns of adjacent beetle killed trees.

6. Impact to fisheries: If salmon spawning streams are bordered by large diameter spruce and these trees are subsequently killed by spruce beetles, there is a concern as to the future availability of large woody debris in the streams. Large woody debris in spawning streams is a necessary component for spawning habitat integrity.

7. Impact to watersheds: Intense bark beetle outbreaks can kill large amounts of forest vegetation. The "removal" of significant portions of the forest will impact to some degree the dynamics of stream flow, timing of peak flow, etc. There have been no hydrologic studies in Alaska quantifying or qualifying impacts associated with spruce beetle outbreaks. Impact studies, however, have been done elsewhere. In Idaho watersheds impacted by the Mountain Pine Beetle, there was a 15% increase in annual water yield, a 2-3 week advance in snowmelt, and a 10-15% increase in low flows.

There are a variety of techniques that can be used to prevent, mitigate, or reduce impacts associated with spruce beetle infestations. However, before pest management options can be developed, the resource objective(s) for a particular stand, watershed, landscape, etc. must be determined. The forest manager must evaluate the resource values and economics of management actions for each stand in light of management objectives. The beetle population level must also be considered because population levels will determine the priority of management actions and the type of strategy to be invoked. The key to forest ecosystem management is to manage vegetation patterns in order to maintain species diversity, both plant and animal, while providing for a multitude of resources such as recreation, fisheries, wildlife, and the production of wood fiber. Properly applied silvicultural practices as well as fire management in south-central and interior Alaska, can maintain the forest diversity needed to provide the range of products and amenities available in the natural forest for now and in the future.

BARK BEETLES

Spruce Beetle

Dendroctonus rufipennis Kirby

Aerial surveys conducted this year demonstrated a continuation of the downward trend in spruce beetle damage in terms of new and active infestation acres mapped. Statewide aerial surveys detected **86,038** acres of new spruce beetle activity in 2000. Since the peak of 1.1 million acres in 1996, new spruce beetle activity has decreased by 92%. Figure 3 shows the rise and fall of annual spruce beetle acres since 1990. The 86,038 acres mapped in 2000 is the lowest recorded acreage in more than 20 years.

Figure 4, on the following page, shows how yearly aerial survey mapping totals compare over four regionals. Although figure 4 only depicts acres since 1994, the Kenai Peninsula and Copper River regions have, respectively, accumulated 1,400,000,and 650,000 acres of spruce beetle infestations since 1991. Total cumulative acreage for all spruce beetle outbreaks during the last 10 years in Alaska is approximately 2.9 million acres.

The overall decline in new spruce beetle activity the past few years is a common trend in areas that are now

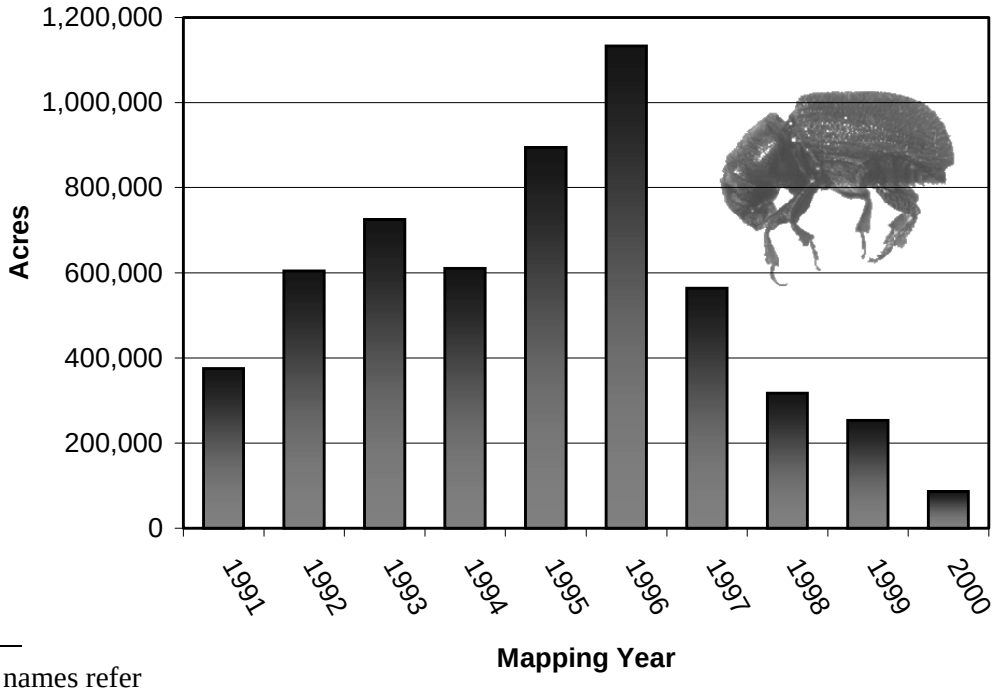


Figure 3. Alaska Region Spruce Beetle Activity (1991-2000)

* The number following place names refer to ecosystem section designations. Refer to page 7 and Appendix D.

depleted of large-diameter spruce host material. However, spruce beetle infestations are still active in many areas of the state, though at a much smaller scale, generally in areas that were previously undisturbed and adjacent to ongoing infestation centers. Spruce beetle populations are expected to persist in these same areas for several more years until a combination of weather conditions, lack of suitable host material, or other disturbance (e.g., timber harvest) occur to significantly reduce beetle populations. As these changes occur, spruce beetle populations will continue to persist at more normal, endemic levels in these same forest areas unless some type of disturbance occurs which increases beetle populations to epidemic levels, such as a wind event (stem breakage and blowdown), wildfire, or some other factor that would favor beetle buildup (e.g., tree stress or favorable conditions for beetle dispersal). Areas that have already been severely impacted, such as on the mainland Kenai Peninsula, no longer contain a significant component of live, mature spruce to sustain bark beetle outbreaks of any magnitude. They will remain at moderate to high risk for potential catastrophic wildfire over the next 5-15 years and possibly longer.

Most areas that sustained active spruce beetle infestations in the current statewide outbreak have been reduced to endemic population levels. A few areas still have active infestations even though mapped acres are insignificant compared to the acreage mapped the last few years. For example, localized infestations were mapped in 2000 in the Copper River Valley from Glennallen to McCarthy (B8), Iliamna Lake (m7), Lake Clark and vicinity (B3), the northern part of the Kenai Peninsula, the east end of Kachemak Bay on the southern Kenai Peninsula (M6), the Matanuska-Susitna Valley, and along the Anchorage Hillside (B5). Spruce beetle activity on the Chugach National Forest has declined for the third year, and by 84% from 1999 totals (from 16,500 ac to 2,650 ac; Seward (M6) quadrangle). Areas with the most intense beetle pressure in south-central Alaska include the west end of the south-side Kachemak Bay from Sadie Cove to Seldovia (M6), a narrow coastal band extending up to 4 miles inland between Ninilchik and Homer and a small area of intense activity in the vicinity of Beluga River on the west side of Cook Inlet (B5).

Spruce beetle activity on the northern portion of the Kenai Peninsula remains static. For comparison,

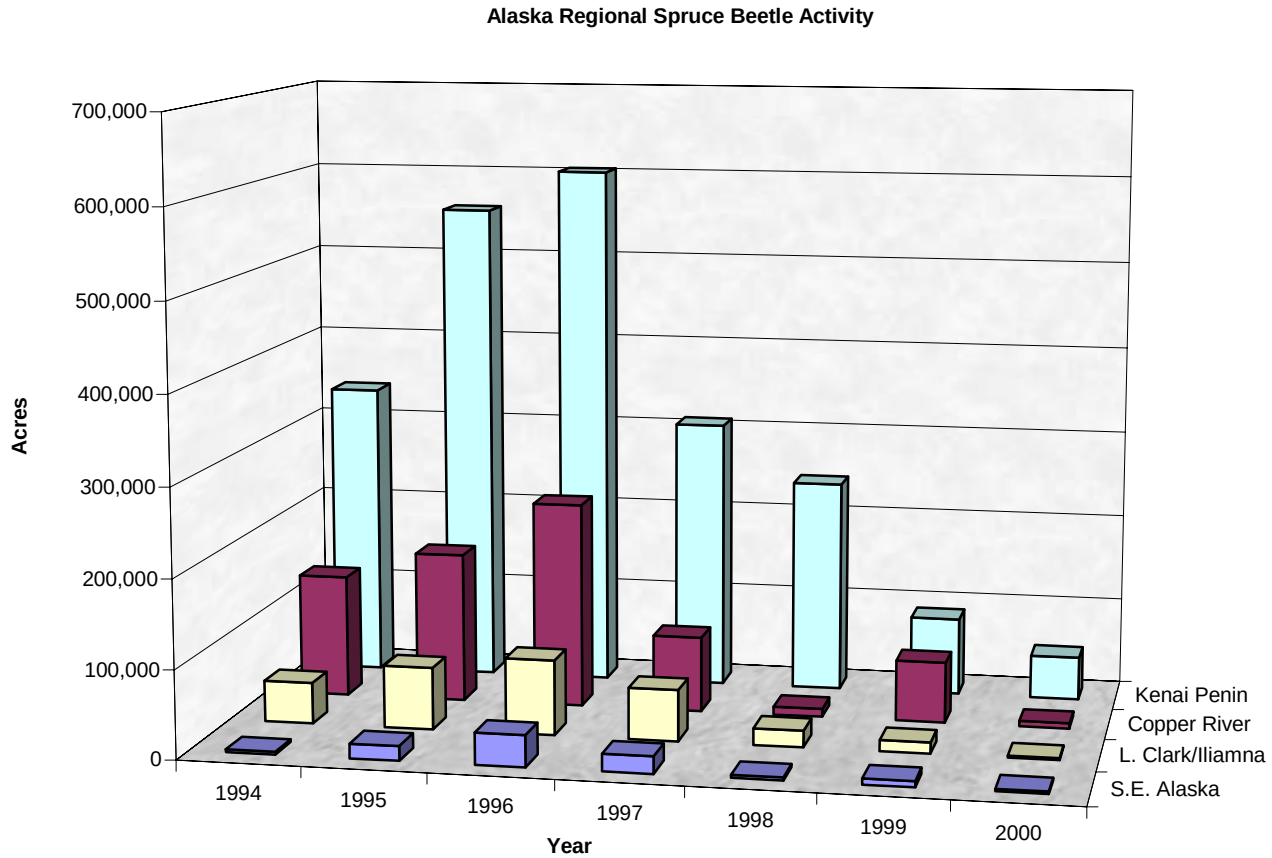


Figure 4. Regional spruce beetle activity since 1994. Note the unusual low in 1998 for the Copper River region was due to poor aerial survey visibility from weather and smoke.

spruce beetle activity sketchmapped in the Kenai quadrangle was 42,100 acres in 1999 versus 30,300 acres of new activity acres mapped in 2000. Beetles continue to be active along the ridge areas above and north of Homer to Anchor Point (B5). Beetle populations, however, in the lower elevation stands in and around Homer have collapsed with most of these pure stands having more than 90% tree mortality. No new beetle activity was observed east of Homer to the Fox River at the head of Kachemak Bay. Most of the coastal stands 1-2 miles inland from Ninilchik south to Homer have received heavy spruce beetle pressure the last 3 years as adjacent beetle populations have moved to the remaining susceptible spruce habitat. On the south side of Kachemak Bay (M6), spruce beetles still remain active from the east side of Tutka Bay all the way to Seldovia. Beetle activity in the Seldovia quadrangle, which encompasses most of the southern tip of the Peninsula and southside Kachemak Bay to Seldovia areas, went from 30,900 acres in 1999 to 18,900 acres of new infestations in 2000. Beetle activity on the east end of Kachemak Bay in China Poot Bay, Halibut Cove, Mallard Bay, to Bradley Lake has essentially run its course. Most of these stands now have significant amounts of spruce stem breakage from wind damage. Overall, Kenai Peninsula spruce beetle activity has decreased from 49,200 in 1999 ac to 73,000 ac in 2000; a 33% decrease).

Active spruce beetle infestations continued in 2000 in west-side Cook Inlet stands within Kenai Peninsula Borough, State of Alaska, and Alaska Native regional corporation ownerships. New infestation decreased significantly to 3,700 acres mapped versus 40,100 acres in 1999 (Tyonek (B5) quadrangle area). Most of the continuing and new beetle activity was observed north of Tyonek, between the Beluga River drainage and Little Mt. Susitna (2300 ac), with scattered small spots of new activity along the coastal lowlands between Beluga, and easterly toward Anchorage. The long-infested stands between Tyonek and Tuxedni Bay did not show visible, new spruce beetle activity and are now composed of 90+% beetle-killed spruce. Previously mapped spruce beetle infestations located in the vicinity of Big River Lakes and the entrance to Lake Clark Pass have essentially run their course, with beetles having killed the majority of the spruce host type. The majority of the remaining spruce stands on the west side of Cook inlet, which have been under beetle attack for the past several years, are in similar condition. The beetles have eaten themselves out of "house and home".

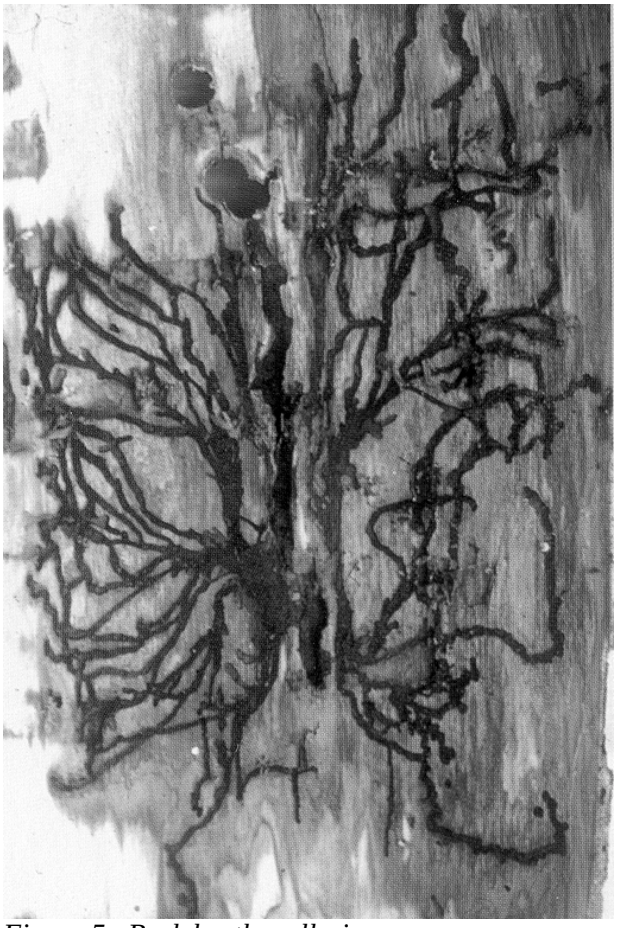


Figure 5. Bark beetle galleries.

In the Lake Clark area on the west side of the pass and southwesterly toward Lake Iliamna spruce beetle activity has decreased about 82% from 1999 levels. This is evidenced by approximately 12,700 acres mapped in 1999 vs. 2,300 acres this year (Lake Clark and L. Iliamna quadrangles). Nonetheless, spruce beetle activity increased in 2000 along the northeast corner and east side of Iliamna Lake (B3) to 2,250 acres mapped from 610 acres in 1999. Most of the Lake Iliamna activity (1600 ac) is occurring near the village of Pedro Bay. The Lake Clark and Iliamna Lake spruce beetle outbreaks were first observed in 1992, peaking at approximately 85,200 acres in 1996.

Continued spruce beetle activity, especially in the Iliamna and Lake Clark regions is of concern to resource managers and will be monitored over the next several years. There remain several areas of contiguous, mature spruce host type in this region that have not sustained any appreciable spruce beetle infestation during the decade of the current epidemic. These areas have the potential for large spruce beetle outbreaks given a future change in local climatic conditions or a disturbance event (e.g., blowdown, top breakage, etc.). Significant forest resource values such as aesthetics, impacts to wildlife habitat and

populations, and subsistence use could be affected by a massive spruce beetle outbreak in this region similar to the Kenai Peninsula and Copper River outbreaks. Close monitoring of the mature spruce forests in this region is warranted.

The Susitna valley remains static in numbers of new beetle infestations mapped this year with 800 acres compared to 1,500 acres mapped in the same areas in 1999 (Talkeetna & Talkeetna Mts. Quadrangles, B3). This is characteristic of the mixed spruce and birch stands growing throughout the MatSu Valley lake country that have a mosaic of age classes and stocking levels. Also characteristic is the location of most of this new beetle activity along the Susitna River and its tributaries which receive continuous river bank erosion and fallen, large-diameter, green spruce. Areas of fresh spruce blowdown continue to be the primary centers that will sustain increases of beetle populations above endemic levels. The epidemic is aided by favorable environmental conditions for beetle brood survival and adult dispersal.

Similar to 1999 surveys, Copper River area spruce beetle activity is concentrated east of the Richardson Highway near Copper Center and north of the Copper River between Chitina and McCarthy. Approximately 5,500 acres of active beetle infestation were mapped compared to 39,300 acres in 1999 (McCarthy quadrangle, B9). Most of this acreage is "light to moderate" in intensity and is concentrated primarily on National Park Service lands. Many of these stands have a significant component of black spruce, which is not as susceptible to beetle attack. The current infestation has been in progress for about 5-7 years and will probably persist at low to moderate levels for several more years due to the extensive acreage of this mixed white/black spruce type. Finally, the areas of beetle activity that were observed in 1999 along the Hanagita and Bremner (M6) river drainages east of Valdez were flown again this year and found to be inactive in terms of visible "red-topped" spruce in 2000. It appears that the infestations in those areas were active for about 3-4 years and the available habitat of mature, susceptible spruce have succumbed to the spruce beetle.

New spruce beetle activity within the Municipality of Anchorage (B5) along the Eagle River and Anchorage hillside areas was almost nonexistent in 2000 based on general observations of the forest specialists that have tracked this activity. Specific acreage of new beetle activity is minor. An intense aerial or ground infestation survey was not conducted of the Anchorage Bowl areas during 2000. The University of Alaska Cooperative Extension Service reported concentrations of new beetle activity above Potter Marsh and along Birch and Campbell Airstrip roads, on the lower Anchorage Hillside and scattered pockets of activity in Eagle River. Private landowner reports received throughout the summer indicate that discrete pockets of moderate to heavy beetle activity persist mainly in "islands" of mature spruce adjacent to infested areas. These spruce islands have received heavy pressure from the large beetle populations of the last few years and may have been aided by local wind events which dispurse beetles into new areas. Since 1990, approximately 85,000 acres of cumulative infestation have been mapped within the Anchorage municipal boundary (MOA). About forty percent is distributed within the greater Anchorage area including Fire Island

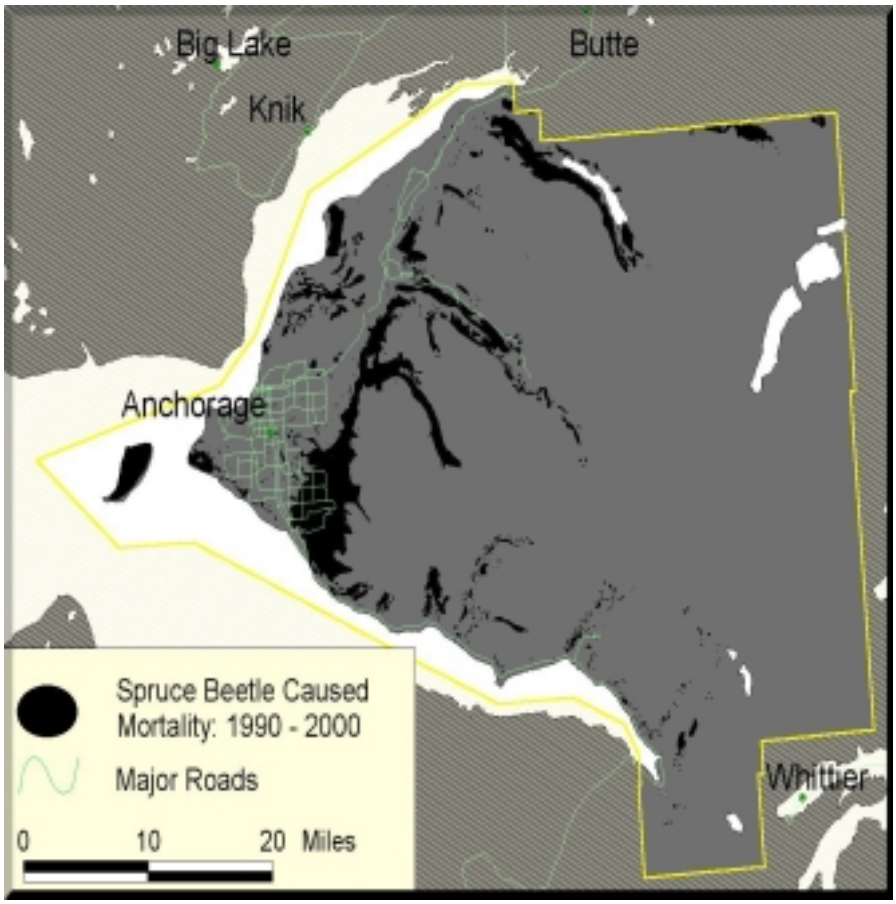


Figure 6. Spruce beetle caused mortality in the Anchorage Municipality since 1990 is shown in Black. Mortality in areas sourounding the municipality are not shown.

and the Hillside areas (35,000 ac). Some activity has occurred along the north side of Turnagain Arm south to the Portage valley (4,000 acres); the remaining infestation activity over this 11-year period has been mapped in and along the Eagle River hillside and Valley (14,000 ac), Eklutna Lake and Valley (16,000 ac), and the Knik River Valley (18,000ac). Current management activities within the infestation areas have centered on the development of wildfire and fire hazard management plans by the local fire fighting and resource agencies and include the formation of cooperative partnerships, identification of protection corridors, and project work to reduce fuels loading at strategic initial attack points.

Scattered spruce beetle activity still persists along the Kuskokwim River downstream from McGrath and along Big River. Beetle activity increased to 4,700 acres from 1,200 acres mapped in 1999 (+292%; McGrath quadrangle). Beetle populations remain active near Sleetmute, on the lower Kuskokwim, but have decreased 45% from 1999 levels (1000 ac vs. 1,800 ac; Sleetmute quadrangle). Small-scale logging operations and localized flooding events have probably contributed to this past activity although periodic wildfires in these interior areas help mitigate expansion of these localized outbreaks. Interestingly, an area east of Nome near Elim on the south-side Seward Peninsula was checked for beetle activity by special request and 3,700 acres of new beetle activity were observed (Solomon quadrangle). The Elim infestation appeared to have been active for several years and had previously been visited about 9 years ago. Mapping of beetle activity in the more remote areas of the Alaska interior is a continuing challenge due to changing weather, periodic smoke, which affects survey visibility, and other logistical issues that make yearly comparisons difficult. However, continued monitoring of these areas is critical to establish baseline information that is important for determining forest health trends and the overall condition of Alaska's forests.

Spruce beetle activity in southeast Alaska's Sitka spruce forests declined to 2,700 acres in 2000 vs. 6,500 acres in 1999 and from a peak of 35,700 acres in 1996 (93% decrease). Current spruce beetle activity continues in areas that were infested in 1999, and is concentrated in the Skagway quadrangle along the upper Chilkat River near Tihitkah Mountain (1,200 ac), in the Yakutat quadrangle within Glacier Bay National Park and Preserve, and Tongass N.F. lands along the Alsek River at Dry Bay (1,200 ac) and Deception Hills at the head of the Grand Plateau Glacier (400 ac).

To summarize, spruce beetle activity in Alaska has decreased significantly since the peak year of 1996. New spruce beetle activity is occurring in stands composed of pure spruce with few hardwoods interspersed in the canopy. Entomologists anticipate that beetle activity will continue in the major outbreak area of the Kenai Peninsula for several more years until the mature, spruce host type is depleted. New and smaller localized outbreaks are expected, however, if climatic and stand conditions become favorable in areas that have been previously infested. For the last 3 years, climatic trends have cycled to a more cool and wet summer pattern for south-central and interior Alaska, and are less favorable for spruce beetle population buildup. Spruce beetle populations are expected to remain at endemic levels for several years unless the current climatic patterns shift. Past bark beetle outbreak areas will be monitored closely over the next 2-3 years especially on the southern Kenai Peninsula, lower Copper River region between Valdez and Glennallen, the Iliamna and Lake Clark regions, and along the major interior Alaska river systems such as the Yukon, Kuskowim and Tanana that are periodically subject to flooding, erosion, and siltation disturbances.

Engravers

Ips perturbatus Eichh.

Engraver activity increased by 505% from approximately 3,800 acres in 1999 to 23,000 acres detected from 2000 aerial surveys. The bulk of this activity is concentrated in interior Alaska where *Ips* infestations occur primarily along river floodplains and areas disturbed by past erosion, spruce top breakage (e.g., snow loading), harvest, or wind. Most *Ips* activity is very localized and can be distinguished from spruce beetle damage by dying and reddening upper crowns in mature spruce. *Ips* are often associated with spruce beetle in the same general areas, however, *Ips* typically respond faster than spruce beetle in these areas since they are a more aggressive bark beetle in keying in to host stresses and nutrient changes brought on by these various disturbances. *Ips* activity in 2000 is noted in table 4 by USGS quadrangle location (1999 activity, for these quads, if any, is also noted):

Table 4. Engraver activity

USGS Quad	Acres	
	2000	1999
Bettles	118	
Charley River	108	169
Circle	228	35
Fairbanks	29	8
Ft. Yukon	81	106
Holy Cross	12,222	16
Hughes	20	
Kantishna River	23	773*
Medfra	47	61*
Russian Mission	5,408	
Shungnak	55	20
Sleetmute	4,522	11
Survey Pass	47	
Tanacross	8	
Tanana	15	3
Taylor Mts.	62	
Wiseman	7	86

* mapped as "IPB" (*Ips* and spruce beetle)

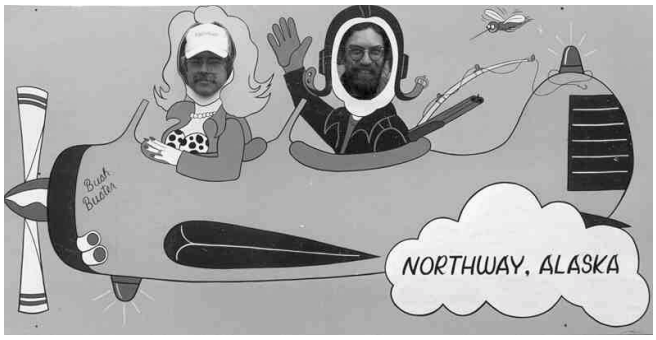
Because of the difficulty in separating *Ips* and spruce beetle activity when both occur in a stand it is often necessary to conduct periodic ground checks to determine the primary mortality agent. The shorter life cycle of the *Ips* beetle can help populations build quickly in the tops of spruce trees also infested by spruce beetles. On the Kenai Peninsula, this dual association has been particularly challenging in cutover areas when spruce slash has been left on the ground following harvest or a significant component of smaller diameter spruce remain on site after harvest. If enough suitable brood material remains, *Ips* numbers can increase to levels large enough to infest standing, healthy trees. Ground surveys were initiated in 2000 to determine how bark beetles in general have impacted residual spruce in both harvested and unharvested stands on the Kenai Peninsula. One objective of the "*Ips* survey" project is to determine the importance of *Ips* populations in driving the current spruce beetle epidemic.

Aerial surveys can provide estimates of year-to-year trends in total *Ips* activity and relate this activity to localized host disturbance events. This information can be an important component of establishing overall forest health and pest monitoring trends that would be used to guide forest management activities. Refer to the fold out map 5, General Forest Pest Activity, for general locations of *Ips* activity mapped in 2000.

Miscellaneous Bark Beetles

Pityophthorus nitidulus (Mannerheim)
Polygraphus rufipennis (Kirby)

These secondary bark beetles of the family Scolytidae are commonly found breeding in dead and dying spruce in Alaska and are not noted as tree killers. These two scolytidas, however, were responsible, in part, for the death of more than 40 recently planted Colorado blue spruce in the Anchorage Bowl (B5). The trees were imported from Idaho and were experiencing transplant shock from having their large woody roots severed.



DEFOLIATORS

SOUTHEAST ALASKA DEFOLIATOR PLOTS

Fewer defoliator plots (32 plots) were visited during the 2000 aerial survey than in previous years (52 plots) throughout southeast Alaska. An effort was made to distribute these plots evenly across the archipelago.

Larval counts can be used as a predictive tool for defoliator outbreaks. The total count for all insects in 2000 was only about one-half of that in 1999 which indicates that hemlock sawfly is not at outbreak numbers. Hemlock sawfly counts were higher for some plots in 2000 than in 1999. The highest sawfly larval count was from the plot in Thorne Bay (M4), more than twice the number of larvae counted at the other eleven locations.

Figure 7. Progression of top-kill following repeated budworm defoliation.

Spruce Needle Aphid

Elatobium abietinum Walker

Spruce needle aphids feed on older needles of Sitka spruce, often causing significant amounts of needle drop (defoliation). Defoliation by aphids cause reduced tree growth and can predispose the host to other mortality agents, such as the spruce beetle. Severe cases of defoliation alone may result in tree mortality. Spruce in urban settings and along marine shorelines are most seriously impacted. Spruce aphids feed primarily in the lower, innermost portions of tree crowns, but may impact entire crowns during outbreaks. Outbreaks in southeast Alaska are usually preceded by mild winters.

Following the mild winter of 1991-92, spruce needle aphid populations expanded rapidly in southeast Alaska, causing over 25,000 acres of Sitka spruce defoliation. Populations crashed in 1993 due to extended periods of sub-freezing temperatures during January and February. After a slight resurgence of activity in 1994, the 1995 population levels were low. Another outbreak occurred in 1998 following another mild winter, resulting in 46,300 acres of defoliation. Southeast Alaska accounted for 44,300 acres with 39,100 of those acres on national forest lands.

In 2000, 39,400 acres of defoliation were detected, almost as many acres as in 1998. Seventy-five percent of these acres (29,500 acres) were on national forest lands (M4). The defoliation in 2000 was primarily on south to west facing slopes.

Western Black-Headed Budworm

Acleris gloverana Walsingham

The black-headed budworm is native to the forests of coastal and southwestern Alaska. It occurs primarily in southeast Alaska and has been documented there since the early 1900's. Budworm populations in Alaska have been cyclic, arising quickly, impacting vast areas, and then subsiding within a few years.

In southeast Alaska, a peak year for budworm defoliation occurred in 1993, totaling 258,000 acres. The last budworm outbreak of this magnitude occurred from the late 1940's to mid-1950's. Cool-wet weather in early summer months retards the growth and development of the budworm and may have resulted in population declines. Black-headed budworm populations crashed in 1995. In 1998, 1999, and 2000 no budworm defoliation was aerially detected.

Hemlock Sawfly

Neodiprion tsugae Middleton

Hemlock sawfly, a common defoliator of western hemlock, is found throughout southeast Alaska. Historically, sawfly outbreaks in southeast Alaska have been larger and of longer duration in areas south of Frederick Sound (M4). In 1999, sawfly defoliation was virtually nonexistent, this coming after a peak in 1997 when 2,500 acres were recorded.

In 2000, most of the 5,200 acres of activity occurred in "hot spot locations"(M4) in Kasaan Bay, Prince of Wales Island, Burroughs Bay north of Ketchikan, and Windham Bay east of Admiralty Island.

Unlike the larvae of the black-headed budworm, hemlock sawfly larvae feed in groups, primarily on older hemlock foliage. These two defoliators, feeding in combination, have the potential to completely defoliate western hemlock. Heavy defoliation of

hemlock by sawflies is known to cause reduced radial growth and top-kill. Hemlock sawflies may ultimately influence both stand composition and structure. The sawflies themselves are a food source for numerous birds, other insects, and small mammals.

Spruce Budworm and Coneworm

Choristoneura fumiferana (Clemens)
Choristoneura orae (Freeman)
Dioryctria reniculelloides Mutuura & Munroe
Zeiraphera spp.

In 2000, approximately 40,844 acres of lightly defoliated spruce was concentrated in one area along the Christian River approximately 25 miles north of Fort Yukon, extending nearly 18 miles (B2,B6). The spruce defoliation could be caused by either the eastern spruce budworm, coneworm, or bud moth; however, ground verification was not done. This area will be flown again in 2001 and the insect identified if possible.

It appears that after more than five consecutive years, the budworm/coneworm outbreak along the Yukon River has ended probably due to the increasing effects of parasites and predators. We expect little defoliation next year. A ground survey, conducted in late summer of 1999 by Tanana Chief Council crews, noted no mortality associated with the budworm/coneworm outbreak, although top-kill was prevalent. Little *Ips* spp. activity was noted in previously defoliated spruce stands.

Larch Sawfly

Pristiphora erichsonii (Hartig)

Total area of land affected by the larch sawfly in 2000 was 64,859 acres; a significant reduction from the more than 190,000 acres of defoliated larch observed in 1999.

The area of most intense activity remains the vast area between McGrath and the Alaska Range (B10). After eight years of heavy defoliation, larch mortality is now occurring throughout the range of larch in Alaska. The concern still exists that larch beetle may begin to build up in these heavily defoliated stands which could result in further mortality. The Alaska Cooperative Extension Integrated Pest Management Technicians noted localized defoliation of Siberian larch in the Mat-Su Valley and Anchorage Bowl for the second consecutive year (B5). This is the first time the sawfly has been recorded south of the Alaska Range and no doubt represents an accidental introduction. Efforts are being undertaken to eradicate this pest from these areas as Siberian larch is widely used as an ornamental in urban settings.

Figure 8. Larch sawfly larva

Aspen Leaf Miner

Phyllocnistis populiella (Chambers)

Widespread, intensive defoliation of aspen by the aspen leaf miner was noticeable throughout interior Alaska, especially from the Tanana Valley north to Eagle and west into the Yukon Territory, Canada (B13, B15).

Meandering larval mines are produced in the epidermal layers on the undersides of leaves. Such mining reduces the photosynthetic area of the affected leaves. Heavy repeated attacks reduce tree growth and may cause some top-kill.

Figure 9. Note the leaf miner's meandering pattern on this aspen leaf.

Adult moths overwinter under bark scales of aspen. Adults emerge in early June and deposit eggs singly on the leaf edge then slightly fold the leaf to form a protective covering for the egg until larval emergence. The newly hatched larvae bore into feed between

epidermal leaf tissues. Pupation occurs within the larval leaf mines. Adult emergence occurs prior to or sometimes after the leaves drop in late August and September.

Birch Defoliation

Fenusa pusilla (Lepeletier)

For the fourth consecutive year, birch defoliation was very noticeable in the Anchorage Bowl (B5) from late July to August. Although these hardwoods have been defoliated for several consecutive years, as yet there doesn't appear to be any lasting damage.

The birch leafminer was first reported in eastern United States in 1923. Introduced from Europe, it has spread rapidly throughout the northern United States, Canada, and Alaska. The adult sawfly is black, about 3 mm long, and similar in appearance to a common fly. Larvae overwinter in cocoons in the soil and adults appear in the spring when the first birch leaves are half grown. The female sawfly deposits her eggs singly on newly developing leaves. At times, almost every leaf is mined by the developing larvae, giving it a brown color. When mature, the larva cuts a hole through the leaf and drops to the ground. There the larvae build a cell in which pupation takes place; 2-3 weeks are usually required for transformation into the adult stage. A re-flushing of leaves may occur, and a second generation of egg-laying sawflies may develop. Two to four generations of this insect can develop in northeastern US; the number of generations in Alaska is not known.

Large Aspen Tortrix

Choristoneura conflictana Wlkr.

Throughout Alaska, tortrix defoliation of aspen declined for the second year in a row to only 5,576 acres, down from 13,336 acres in 1999. This decline is consistent with the cyclic nature of these insects.

The most active populations affected approximately 4,300 acres with moderate to light defoliation near Nenana along and south of the Tanana River (B10). Approximately 1,100 acres of moderate defoliation occurred along the Dalton Highway (B2) between Bettles and the Yukon River.

Historically, populations of tortrix tend to cycle over time in response to environmental conditions. The consistent trend is a pattern of one to two years of increasing activity followed by two to three years of decline. Weather, starvation and parasites are the most important factors in precipitating these declines. It is difficult to make predictions about future populations of this insect.

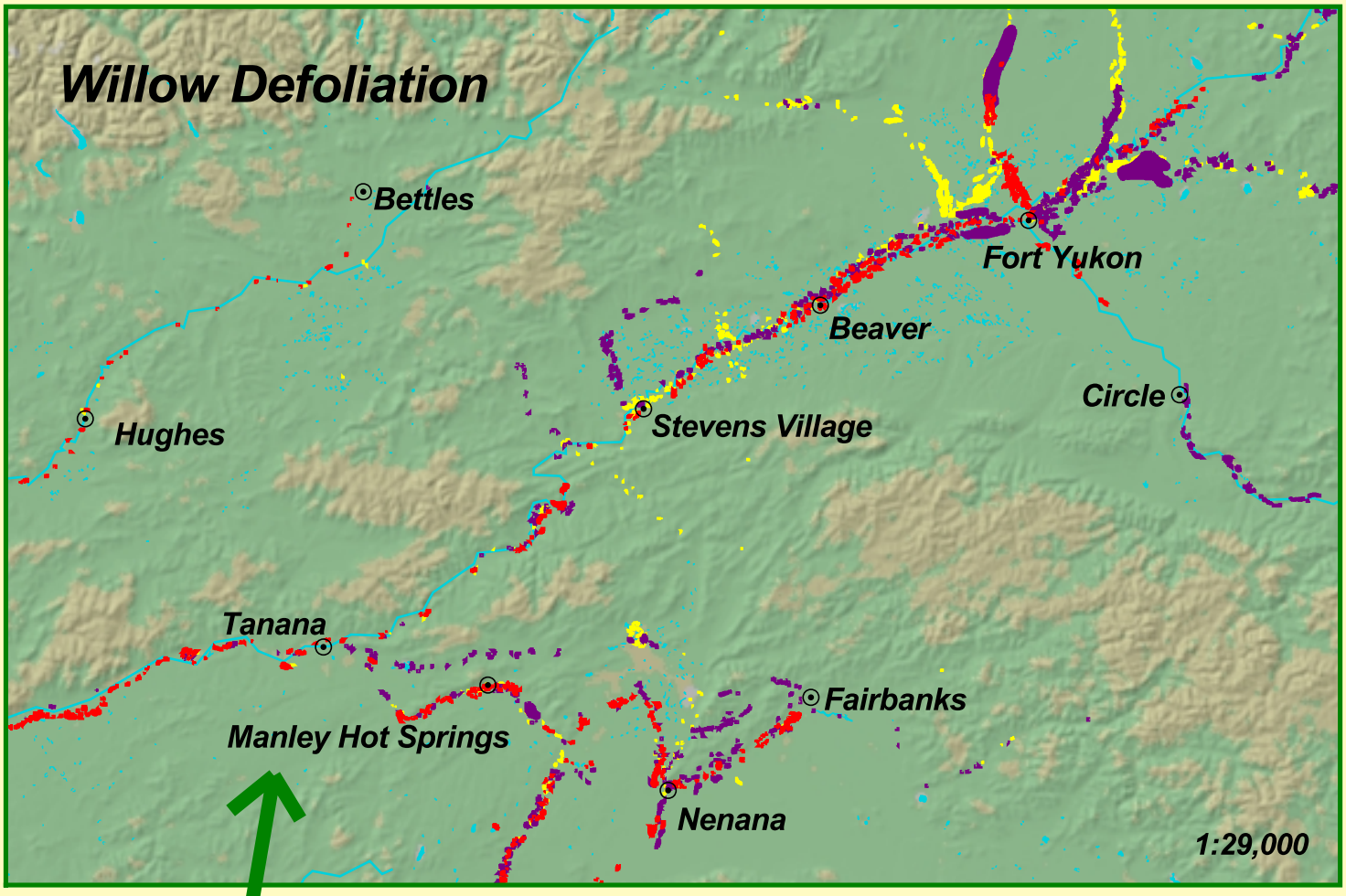
Cottonwood Defoliation

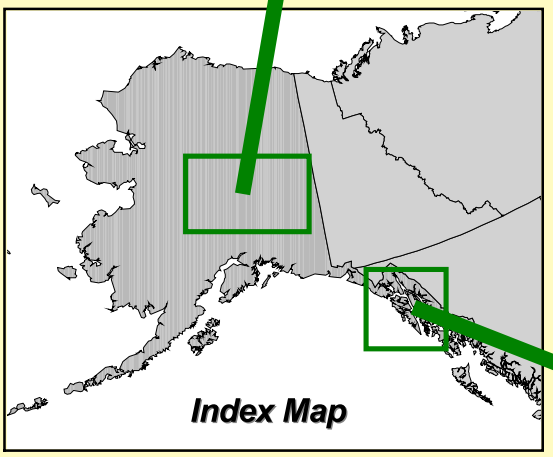
Chrysomela spp**.**
Epinotia solandriana L.

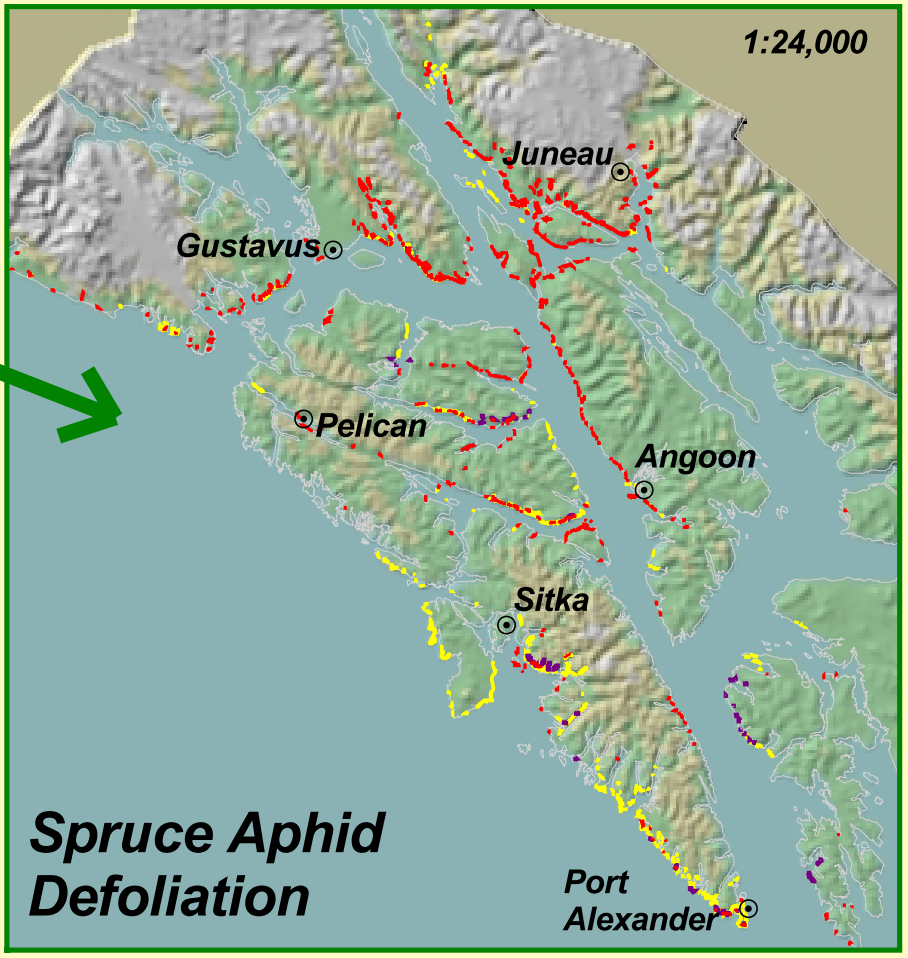
Cottonwood defoliation by the cottonwood leaf beetle was barely noticable throughout south-central and interior Alaska. Only three spots were noted during the 2000 survey. One area, 119 acres, was on Big River (B10) south of McGrath. The second area, 97 acres, was on the Skwentna River near Shell Lake; and the third area, 28 acres, was on the Susitna River just south of Susitna (B5).

In Southeast Alaska, the majority of cottonwood defoliation on the southern end of Russell Fiord near Yakutat was attributed to a leaf roller. The leaf roller contributed over 5,100 acres of cottonwood defoliation and over 4,900 acres of alder defoliation, also in Russell Fiord

Willow Defoliation







Spruce Aphid Defoliation

Year Mapped

- 2000 Defoliation
- 1999 Defoliation*
- 1998 Defoliation*

* May be masked by subsequent year

Sources:
1998 - 2000 Insect damage from I&D Aerial Survey, USFS FHP & ADNR.

USDA Forest Service
Forest Health Protection
Date Printed: 11/30/2000

Map by Dustin Wittwer

Willow Leaf Blotchminer

Micrurapteryx salicifolliela (Chambers)

The outbreak of the willow leaf blotchminer continued in 2000. This year, defoliation was reported on 36,002 acres vs. 180,396 acres noted in 1999. The acreage figure is rather deceiving considering the range of damage. Blotchminer activity covers both the Yukon and the Tanana River drainages and their tributaries from the Canadian border to McGrath and Holy Cross (B2, B3, B6, B7, B10, B12, B13, B15). Most of the defoliation occurred between Ruby and Ft. Yukon, 22,412 acres, along the Yukon River (B2, B6, B7) and from Tanana to Fairbanks, 4,293 acres along the Tanana River (B2, B7, B10, B13). Oftentimes, the brown-appearing, defoliated willow stretches as far as one can see from the air; however, cost prohibits more thorough coverage. Intensive willow mortality has been observed in the Yukon Flats area and the concern remains that this mortality may have a detrimental effect on availability of willow sprouts, upon which moose depend heavily as a food source. Prior to this outbreak, this insect was not identified in Alaska.

This insect has one generation per year with the pupal stage as the overwintering stage. Ten species of willows have been observed infested, the severity of which differed somewhat between localities and species. Feltleaf willow, *Salix alaxensis*, is not infested due to its under leaf surface being covered by a protective felt-like mat of hairs that prevents attachment of blotchminer eggs.

Gypsy Moth

Lymantria dispar (L.)

The European gypsy moth was accidentally introduced into the eastern U.S. in the late 1800's and has been responsible for considerable damage to the hardwood forests of the east. The gypsy moth has also been introduced to the western U.S. where millions of dollars have been spent on its eradication.

Since 1986, Forest Health Protection, in conjunction with Alaska Cooperative Extension and USDA APHIS, has placed gypsy moth pheromone monitoring traps throughout Alaska. To date, only two European gypsy moths have been trapped in Alaska. As far as we know, populations of the gypsy moth have not been established in Alaska. Due to the detection of the Asian gypsy moth (a more damaging race of the European gypsy moth) in the Pacific Northwest, more than 200 detection traps were placed throughout Alaska in 2000. No Asian or European gypsy moths were collected. If the Asian gypsy moth becomes established in the western U.S., including Alaska, the potential impacts to forest and riparian areas could be tremendous. The trapping program will be continued next year.

Figure 10. Gypsy moth larvae

Alder Woolly Sawfly

Eriocampa ovata (L.)

Moderate defoliation of Sitka and thinleaf alder was observed for the fourth consecutive year in many parts of the Anchorage Bowl (213B). Heavy defoliation was also observed throughout southeast Alaska on red alder. This sawfly is a European species now established throughout the northern U.S., Canada, and Alaska. The larvae are covered with a distinctive shiny, woolly secretion. They skeletonize the lower leaves on young alders; the upper crown is usually not fed upon. Populations are expected to decline next year as a result of this summer's cool and wet conditions.

Spider Mites: Acarina

***Paratetranychus* spp. and *Tetracychus* spp.**

Anchorage IPM Technicians (Alaska Cooperative Extension) noticed extensive damage to spruce trees from spider mite feeding for the second consecutive year. This damage was most visible in August and September. Infested trees showed signs of yellowing needles in a “flagging” pattern and green needles appeared dull in color with much webbing present. Some defoliated trees exhibited an overall decline in appearance and then dropped the faded needles. Weeks of warm, dry weather early in the spring may have contributed to the abundance of spider mites.

INVASIVE PESTS

Invasive pests (introduced non-indigenous plants, animals, and microbes) are among the most serious threats to biological diversity in Alaska. To date, few invasive pests have been introduced and established in Alaska. Of concern is the movement of organisms from the continental U.S. into Alaska in light of climate change and increased commerce. A warming trend can increase the probability that organisms accidently introduced into Alaska can become established.

It is inevitable that we are going to see more and more introduced pests arriving in Alaska. If we are not prepared to expend the efforts to safeguard our ecosystems, Alaska will be poorer in terms of resources and biological diversity. USDA APHIS, State of Alaska Division of Agriculture, Alaska Cooperative Extension, and the USDA Forest Service, Forest Health Protection already have small programs in place to detect these introductions. Alaska residents, resource professionals and land managers need to "keep a sharp eye" out for potential introduced pests and quickly contact ACE, APHIS, or the Division of Agriculture. If introduced pests are quickly identified, the probability of successful eradication is increased.

Sitka Spruce Weevil

Pissodes strobi Peck

Adult Sitka spruce weevils were collected for the first time in the Anchorage Bowl in 1995 and again in 1996-97. The weevils were collected from infested nursery stock (blue spruce) brought into the state from the Pacific Northwest. Developing larvae, pupae, and callow adults were encountered in 1998 in out-plantings of spruce in west Anchorage; an indication that the spruce weevil may have adequate developmental conditions to become established in south-central Alaska. A follow-up ground check in the west Anchorage area found no new Sitka spruce weevil activity on new out-plantings. All of the infested shoots seen in this area were clipped and disposed of. In 1999, Sitka spruce weevils were found in a State of Alaska, Department of Transportation landscape planting near Tudor Road and "C" St. in Anchorage. The infested terminals were clipped and destroyed. In the spring of 2000, the Sitka spruce weevil was found to cause the death of dozens of Colorado spruce terminal leaders in nursery stock. The Anchorage nursery had imported the trees from Oregon in the fall of 1999, stored them on a large lot, and the damage was apparent the following April. The affected leaders were removed and destroyed. We will continue to monitor the potential establishment of this serious pest of ornamental and native spruce.

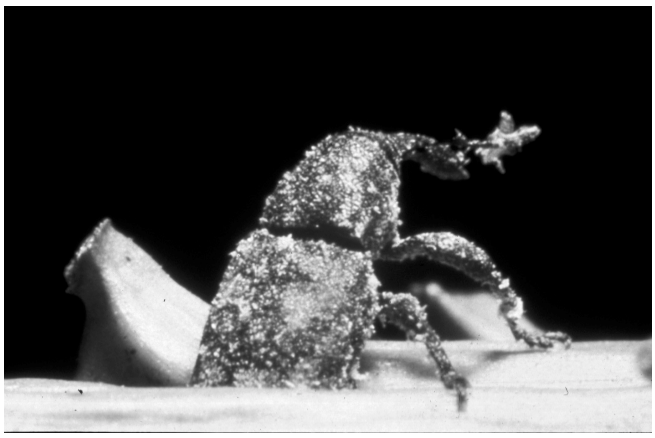


Figure 11. An adult spruce weevil.

European Black Slug: Limacidae

Arion ater

Arion ater, the European black slug, was detected twice in a local Anchorage garden in 2000 and was likely imported on flats of bedding plants that originated from Washington State. A distinctive feature of this slug is the many grooves and ridges along the back. This reddish-brown slug has a distinctive striped red-orange skirt. When fully extended, this slug measures almost 6 inches in length. The European black slug is established in the northwest U.S. and is a serious pest of crops including corn, wheat, potatoes, beans and strawberries.

Bird Vetch

Vicca cracca L.

Do not be deceived by the pretty blueish-purple flowers. This climbing legume has been spotted growing aggressively around south Anchorage for the past several seasons, most notably along the Seward Highway. It is weak-stemmed with compound leaves and has a climbing habit that allows it to grow on and over other plants. It has been observed invading yards, other roadside locations, and along the Turnagain Arm trail in Chugach State Park. *Vicca cracca* is recognized as a restricted noxious weed by the State of Alaska. The easiest method to control this plant is by pulling it wherever encountered and bagging it up for disposal to ensure seeds are not left on site.

Figure 12. Spruce aphid damage can be seen in this Sitka spruce. Aphid killed needles are turning brown leaving only current year needles.

Figure 13. Hillsides can appear reddish orange with an active spruce beetle infestation.

Figure 14. Spruce beetle can help determine the dominant species of a given stand. This spruce beetle infestation will further favor the hardwood component in this stand.

Figure 15. Alder leaf blotch miner.

Map 5. General Forest Pest Activity in 2000

11 X 17 Map – See Filename major_dmgv3.pdf

Map 6. 1999 Survey Flight Paths Showing Ownership

11 X 17 Map – See Filename flighpath00.pdf